UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

JÉSSICA FERREIRA DE ALMEIDA

**Third molar position after Class II subdivision malocclusion
treatment with asymmetric extractions**

**Posição dos terceiros molares após tratamento da má oclusão de
Classe II subdivisão com extrações assimétricas**

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Dissertação constituída por artigo apresentada à Faculdade de Odontologia de Bauru da Universidade de São Paulo para obtenção do título de Mestre em Ciências no Programa de Ciências Odontológicas Aplicadas, na área de concentração Ortodontia.

Orientador: Prof. Dr. Guilherme Janson

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e colocarem meus sonhos acima dos seus.*

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ABSTRACT

ABSTRACT

Third molar position after Class II subdivision malocclusion treatment with asymmetric extractions

Introduction: This study aimed to assess the third molars angulation and their available space after Class II subdivision malocclusion treatment with asymmetric premolar extractions. **Methods:** The sample consisted of 37 patients in group 1 (Type 1 Class II subdivision) and 25 in group 2 (Type 2 Class II subdivision). In group 1 extractions were performed in the two maxillary quadrants and in the Class I mandibular quadrant. In group 2, extraction was performed in the Class II maxillary quadrant. Panoramic radiographs were used to evaluate third molars angulation and their available space. Radiographic measurements were performed with Dolphin® Imaging 11.9. T tests were used for intragroup comparison between the sides. **Results:** Generally, the results showed that both Groups demonstrated more favorable angulation and significantly greater space for third molars on the extraction quadrants. Both groups presented mesioangulation in mandibular third molars on the Class II side. **Conclusions:** Extraction therapy is associated with an improvement of space available and third molars angulation on the extraction quadrants.

Keywords: Malocclusion. Third Molar. Tooth Extraction.

RESUMO

RESUMO

Posição dos terceiros molares após tratamento da má oclusão de Classe II subdivisão com extrações assimétricas

Introdução: O objetivo desse estudo é avaliar a angulação e o espaço disponível para irrupção dos terceiros molares após o tratamento da Classe II subdivisão com extrações assimétricas de pré-molares. **Materiais e métodos:** A amostra foi constituída por 37 pacientes no grupo 1 (Classe II subdivisão tipo 1) e 25 no grupo 2 (Classe II subdivisão tipo 2). No grupo 1 as extrações foram realizadas nos 2 quadrantes superiores e 1 no inferior do lado da Classe I. Na tipo 2, foi realizada 1 extração no arco superior do lado da Classe II. Radiografias panorâmicas foram utilizadas para avaliar as angulações e os espaços dos terceiros molares. As medições radiográficas foram realizadas no programa Dolphin® Imaging 11.9. Testes t foram utilizados nas comparações intragrupos entre tempos e os lados. **Resultados:** No geral, os resultados mostraram que os dois Grupos demonstraram angulações mais favoráveis e aumentos significativamente maiores para os terceiros molares dos quadrantes das extrações. **Conclusão:** Tratamento com extração está associado com aumento do espaço disponível e melhora na angulação dos terceiros molares nos quadrantes das extrações.

Palavras-chave: Má Oclusão. Terceiro Molar. Extração Dentária.

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LIST OF ABBREVIATIONS AND ACRONYMS

Ang3MxCLI	Angle formed by the long axis of the maxillary third molar and the infraorbital line on the Class I side
Ang3MxCLII	Angle formed by the long axis of the maxillary third molar and the infraorbital line on the Class II side
Ang3MdCLI	Angle formed by the long axis of the mandibular third molar and the inter mentonian foramen line on the Class I side
Ang3MdCLII	Angle formed by the long axis of the mandibular third molar and the inter mentonian foramen line on the Class II side
Spa3MxCLI	Space available for the maxillary third molar eruption on the Class I side
Spa3MxCLII	Space available for the maxillary third molar eruption on the Class II side
Spa3MdCLI	Space available for the mandibular third molar eruption on the Class I side
Spa3MdCLII	Space available for the mandibular third molar eruption on the Class II side
Ang3Mx	Angular difference of maxillary third molars between T2 and T1
Ang3Md	Angular difference of mandibular third molars between T2 and T1
Spa3Mx	Linear difference of maxillary third molars between T2 and T1
Spa3Md	Linear difference of mandibular third molars between T2 and T1
CAPES	São Paulo Research Foundation.
mm	Millimeter
°	Degree

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1 INTRODUCTION

1 INTRODUCTION

Class II subdivision malocclusion has been studied over the years. Many authors research the influence of skeletal variables on it and although some of them suggested that there is some skeletal involvement, it was concluded that the main cause is dentoalveolar.(ALAVI; BEGOLE; SCHNEIDER, 1988)The dentoalveolar is primarily due to a distal positioning of the mandibular first molars and secondarily by a mesial position of the maxillary first molars or a combination of both.(JANSON et al., 2001)

Since there is a dentoalveolar discrepancy, a dental midline deviation occurs consequently. Thus, if the distal position of mandibular first molars occurs more than the mesial position of the maxillary molars, consequently, there will be more often mandibular dental midline deviation than maxillary dental midline deviation with the midsagittal plane. When the distal position of mandibular first molars with the mandibular midline deviation happens, it is a Class II subdivision type 1, and when there is a mesial position of maxillary first molars with maxillary midline deviated, it is Class II subdivision type 2.(JANSON et al., 2001)

Concerning the treatment options, the type 1 can be treated with 3 or 4 premolars extractions, when the patient profile allows the incisor retraction and considering the amount of crowding. Otherwise, can be treated with unilateral Class II elastics. In Class II subdivision type 2, the best treatment option would be 1 maxillary premolar extraction on the Class II side.(JANSON et al., 2003b)

Janson evaluated the success rate(JANSON et al., 2003a) and the efficiency(JANSON et al., 2007a) of the extraction protocol in the treatment of Class II subdivision type 1 and found that patients treated with asymmetric mechanics of 3 premolar extraction had better occlusal results.

A question that is currently discussed is the influence of the third molars in orthodontic treatment.

It is already established that third molars impaction can cause several pathologies, like cists, tumors, pericoronaritis.(ADEYEMO, 2006)

The most prevalent cause of third molars impaction is due to the lack of space. Another frequent cause is third molars direction of eruption.(KIM et al., 2003)

Studies question if extraction protocols could affect third molars position. Several researches concluded that the premolars extraction will cause molars mesialization with the anchorage loss, increasing retromolar and tuberosities space, decreasing the risk of impaction.(KIM et al., 2003) However, other studies found that the improvement of space is not enough to cause a significant difference in third molars position.(STAGGERS; GERMANE; FORTSON, 1992)

The purpose of this study is to evaluate if there are differences in the available space and third molars position after the Class II subdivision treatment with asymmetric extractions of 3 and 1 premolar.

2 ARTICLE

2 ARTICLE

The article presented in this Dissertation was formatted according to the American Journal of Orthodontics and Dentofacial Orthopedics instructions and guidelines for article submission.

THIRD MOLAR POSITION AFTER CLASS II SUBDIVISION MALOCCLUSION TREATMENT WITH ASYMMETRIC EXTRACTIONS

ABSTRACT

Introduction: This study aimed to assess the third molars angulation and their available space after Class II subdivision malocclusion treatment with asymmetric premolar extractions. **Methods:** The sample consisted of 37 patients in group 1 (Type 1 Class II subdivision) and 25 in group 2 (Type 2 Class II subdivision). In group 1 extractions were performed in the two maxillary quadrants and in the Class I mandibular quadrant. In group 2, extraction was performed in the Class II maxillary quadrant. Panoramic radiographs were used to evaluate third molars angulation and their available space. Radiographic measurements were performed with Dolphin® Imaging 11.9. T tests were used for intragroup comparison between the sides. **Results:** Generally, the results showed that both Groups demonstrated more favorable angulation and significantly greater space for third molars on the extraction quadrants. Both groups presented mesioangulation in mandibular third molars on the Class II side. **Conclusions:** Extraction therapy is associated with an improvement of space available and third molars angulation on the extraction quadrants.

INTRODUCTION

Third molars impaction has been associated to various pathologies including pericoronaritis, cysts, tumors, dental caries, periapical infections, and adjacent tooth root resorption.¹ Third molars lead the rank of higher prevalence of impaction, and the absence of space in the arch is a common etiology,² thus such lack of space is usually influenced by bone remodeling and orthodontic treatment.³ Thus, their development is especially important to professionals, since this can influence the arches.

Studies diverge on how orthodontic treatment can affect third molars eruption space and their angulation. Some researches show that third molars mesialization by interproximal attrition and extraction mechanics increase space for eruption, decreasing the incidence of impaction.⁴ However, studies demonstrate contradictory results about angulation and third molars contact after first and second premolars extraction.⁵

Class II subdivision malocclusion is characterized primarily by distal positioning of the mandibular first molar and secondarily by mesial maxillary first molars positioning on the Class II side.^{6,7}

Class II subdivision malocclusion is divided into two types: type 1 when there is a coincidence of maxillary dental midline with the midsagittal plane and mandibular dental midline deviation to the Class II side; and type 2 when mandibular midline is coincident with the midsagittal plane and the maxillary midline is deviated to the Class I side.⁷

According to treatment protocols, Class II subdivision malocclusion can be treated with extractions or nonextraction. Symmetric extraction of 4 premolars will produce a Class I molar and canine relationship. However, when Class I molar and canine relationship is achieved, a consequence is the correction of midline depending mainly on whether the patient will use diagonal elastics.⁸ However, in asymmetric extraction of three premolars, cases will end with a Class I molar and canine relationship at Class I side and a Class II molar relationship at Class II molar side with midlines coincident with the midsagittal plane.^{7,8} In the Type 2 Class II subdivision malocclusion, the extraction of one premolar is also a possible asymmetric protocol when the maxillary midline deviates. In order to achieve the best result, one premolar extraction can be carried out at the Class II molar side.⁹

Third molars space in Class II subdivision malocclusion has been investigated, and when compared to normal occlusion, was shown that in Type 1 there is a greater space asymmetry for mandibular third molars on the Class II side. Regarding the Type 2, there is a greater space asymmetry for maxillary third molars on the Class II side.¹⁰

Some studies,^{11,12} using cephalometric measures and panoramic radiographs, established that treatment without extraction has been more associated with third molar impactions and that extraction treatment improves their angulation.

Based on those divergences and in the lack of studies, the objective of this study is to evaluate the available space and third molar angulations after Class II subdivision malocclusion treatment with asymmetric premolar extractions.

MATERIAL AND METHODS

This study was approved by the Ethics in Research Committee of Bauru Dental School, University of São Paulo, Brazil (protocol number, 71683417.9.0000.5417) and all subjects signed informed consent.

The sample size was calculated considering an alpha level of 5% and a beta of 20% to detect a difference of 7.81° , with a standard deviation of 12.64 in the variable ROrb.¹³ The sample size calculation showed that 22 patients were required in each group, however, 37 subjects were included in Type 1 and 25 in Type 2. The sample was retrospectively selected from the files of the Orthodontic Department at Bauru Dental School, University of São Paulo, Brazil. Subjects with tooth loss, treated without extraction, treated with extraction of 4 premolars, tumors or infection and without maxillary and mandibular third molars were excluded.

The sample consisted of 2 experimental groups according to their types of Class II. Group 1 comprised 37 patients (17 male, 20 female, mean age 13.18 ± 1.99) with Class II subdivision malocclusion, type 1, characterized by maxillary dental midline coincident with sagittal midline and deviation of mandibular dental midline toward to Class II side, treated with the extraction of 3 premolars. Group 2 comprised 25 patients (10 male, 15 female, mean age 13.56 ± 2.46), with mandibular dental midline coincident to sagittal midline, and maxillary dental midline deviated toward the Class I side, treated with asymmetric extractions of 1 premolar.

The orthodontic mechanics used fixed edgewise appliances, with 0.022 x 0.028-in brackets. The wire sequences 0.015-in twist flex or a 0.016-in nickel-titanium alloy archwire, followed by 0.016, 0.018, 0.020, and 0.021 X 0.025 or 0.018 X 0.025-in stainless steel archwires (3M Unitek, Monrovia, Calif). As anchorage reinforcement, extraoral headgear was used, and Class II elastics were also used when needed. Deep overbites were corrected with accentuated and reverse curve of Spee. The anterior retraction was performed only in the extraction quadrants, with this the deviated dental midline was automatically corrected to the midsagittal plane. Rectangular wires and elastic chains were used for en masse retraction and to correct overjet and Class II canine relationship.

Panoramic radiographs were obtained of each patient at pretreatment (T1) and posttreatment (T2) stages to evaluate the mesiodistal angulation and the space

available for third molars. The radiographs were digitized with (Accugrid XNT, model A30TL.F, Numonics, Montgomeryville, Pa). Points and reference lines were traced by 1 investigator (J.F.A) for radiographic measures by *Dolphin®* Imaging 11.9 program (Dolphin Imaging & Management Solutions, Chatsworth, Calif). The definitions of the radiographs points, distances, and angles between them are shown in Table I.

Assessments of Third molar angulations were measured by the angle between the occlusal surface of the maxillary and mandibular third molars crowns and the infraorbital line and mentonian foramen line, respectively (Fig. 1).

Evaluation of the available space in the maxillary arch was performed by measuring the distance between the distal contact point of the second molar crown to a parallel line intersecting the infraorbital line measuring the tuberosities. In the mandibular arch, between the second molar and the junction of the anterior border of the ramus with the body of the mandible, following the occlusal plane.

The maxillary and mandibular third molars angulation were assessed by measuring the angle formed between the third molars long axis and the infraorbital line and the inter mentonian foramen line, respectively.

For the maxillary and mandibular third molars, positive reading denoted mesial angulation and negative reading a distal angulation. A mesial angulation for the maxillary third molars and a distal angulation for the mandibular third molars were considered as improvements.

Measurements were obtained at pretreatment (T1) and at posttreatment (T2). Treatment changes were calculated as T2-T1.

STATISTICAL ANALYSES

Normal distribution was assessed with Kolmogorov-Smirnov tests. Sex distribution, mean age and treatment time between groups were compared with the Chi-square and t tests, respectively. Intragroup comparisons were performed with paired t tests.

All statistical analyses were performed using Statistica software (Statistica for Windows, version 7.0, StatSoft Inc., Tulsa, Okla, USA), at $P < .05$

ERROR STUDY

Twenty randomly selected radiographs were retraced, redigitized, and remeasured by the same examiner (J.F.A.). The random error was calculated according to Dahlberg's formula,¹⁴ ($Se^2 = \sum d^2 / 2n$) where S^2 is the error variance and d is the difference between 2 determinations of the same variable. Systematic errors were evaluated with paired t tests, at $P < 0.05$.

RESULTS

The random errors ranged from 1.96 (Ang3MxCLII) to 2.69 (Ang3MxCLI) degrees and 0.12mm (Sp3MdCLI). These errors were within acceptable limits.¹⁵ No significant systematic errors were found.

Groups were comparable regarding sex distribution, Class II malocclusion severity, pre- and posttreatment ages and treatment times (Table II).

The intragroup comparison showed that Group 1 presented significant increases in: the mesio angulation and space for maxillary third molars on both sides, in the distal angulation for mandibular third molars on the Class I side, and in the space for mandibular third molars on both sides (Table III).

In addition, Group 2 presented significant increases in: the mesio angulation and space for maxillary third molars on the Class II side, in the distal angulation for mandibular third molars on the Class I side, and in the space for mandibular third molars on both sides (Table IV).

Comparisons between Class I and Class II sides in each group showed that in Group 1 there was a significant difference between the mandibular third molars angulation changes from T1 to T2, demonstrating a distal angulation on the Class I side and a mesial angulation on the Class II side; and a significantly greater increase in the space for mandibular third molars on the Class I side (Table V).

Group 2 had a significantly greater increase in the maxillary third molar mesial angulation and in their space available on the Class II side. Mandibular third molars angulation presented a significant difference between the sides, showing a distal angulation on the Class I side and mesial angulation on the Class II side (Table VI).

DISCUSSION

Several studies evaluated the position of third molars over the years, and panoramic radiographs are widely used in most of them. Some authors reported that it can cause some distortions and do not reproduce accurately.¹⁶⁻¹⁸ On the other hand, others defend that panoramic radiographic images are the choice technique to evaluate third molars due to the fact that they are more accessible, facilitating the communication since they are more commonly used. It is established that panoramic radiographs have specificity ranging from 96% to 98%, presenting reliable linear and angular measurements with consistent accuracy.¹⁸⁻²⁰

Class II subdivision malocclusion has been widely studied. Most of the studies evaluated the characteristics of this malocclusion, assessing their asymmetries, focusing on its diagnosis.⁶ Two types of Class II subdivision malocclusion have been described to lead the treatment protocol choice. Type 1 is characterized by a coincidence of maxillary dental midline with the midsagittal plane and mandibular dental midline deviation to the Class II side and Type 2 when the mandibular midline is coincident with the midsagittal plane and the deviation is in the maxillary arch at Class I side.²¹

Class II subdivision malocclusion treatment can be performed with extractions, considering the soft tissue conditions and amount of crowding.⁷ It has been reported the efficiency of asymmetric extraction protocols including 3 premolar extraction for type 1 and 1 premolar extraction for type 2 subdivision malocclusion.^{8,22} Regarding the third molars, different space availability and angulation could be expected based on their etiology and treatment protocol used for its correction.¹⁰

This study assessed the third molars angulation and space availability after Class II subdivision malocclusion treatment with asymmetric extractions of 3 and 1 premolar. The posttreatment evaluation in Type 1 showed that there was an improvement, observed with a mesial angulation in the maxillary third molar angulations and an increase in the available space on both sides. This result is due to the symmetrical premolar extraction on such arch, agreeing with previous findings which evaluated the position of third molars after premolar extractions.^{11,23,24} Demonstrating increases for third molar space and angulations, since there is a molar

mesialization in the space closure, increasing third molars space and improving their position, causing a decrease in the necessity of their extraction (Table III).

In the mandibular arch, there was an angular improvement (distal angulation) only on the Class I side, which also the side that the premolar was extracted. Concerning the space available, there was an increase on both sides. Although the increase of the space is not expected on the Class II side, this is explained by the mandibular natural growth and agrees with previous studies that also found increases in the retromolar space for third molars eruption, even when no extraction was performed^{4,25} (Table III).

When comparing the T2-T1 differences between sides, Type 1 showed that the maxillary third molar angulations behaved similarly in both sides, as expected because the symmetric mechanics applied, involving 1 premolar extraction on each side, increasing the space for maxillary third molar eruption and consequently producing a mesial angulation²⁶ (Table V).

In the mandibular arch, significant improvement in the angulation and greater improvement in the space were observed on the Class I side (Table V). This was an expected result because of the first premolar extractions on this side, which requires more retraction, providing a significantly greater anchorage loss that causes greater molar mesialization and consequently a greater increase in the space for third molars on this side.²⁷ These results corroborate with previous pretreatment evaluation that observed greater space asymmetry in the mandibular arch in Type 1, due to its subdivision etiology, when compared with normal occlusion.¹⁰

In Type 2, for the maxillary arch, it was observed significant improvements with an increase on its mesial angulation and an increase in the space available only on the Class II side. That was also demonstrated when comparing the changes (T2-T1) between the sides (Table VI). This was expected since there were premolar extractions only in the Class II subdivision malocclusion side^{22,23,26} (Table IV). These findings agree with the pretreatment evaluation that found greater space asymmetry for maxillary third molars in Type 2 when compared with normal occlusion.¹⁰

For mandibular third molars in Type 2, there was also significant increase in the available space on both sides, even without extraction on this arch. Again, this happens

by the mandibular natural growth, increasing the retromolar space, as observed in Type 1^{1,26} (Table IV).

In addition, there was a significant decrease in the mandibular third molar mesial angulation (improvement) only on the Class I side (Table IV). This may be explained due to the numerical smaller mesial angulation that mandibular third molars showed at T1 on the Class I side, also demonstrated when comparing the sides, showing this distal angulation (improvement) on the Class I side, and a mesial angulation (worsening) on the Class II side (Table VI). Studies show that one of the main reasons for third molars impaction is their initial angulation and eruption direction, both compromised with an unfavorable initial position.^{4,28} Türköz,²⁹ reported that the third molar would remain impacted even when there is enough space if its initial angulation was inconvenient. Then, if the mandibular third molar was more mesial angulated (inconvenient angulation) at T1 on the Class II side, little improvement could be expected. Nevertheless, it is only speculation and further studies with larger samples should be performed to confirm these findings.

It is already established that asymmetric premolar extraction protocol has a greater success rate and provides a better occlusal result.^{8,27} Thus evaluation is very important to demonstrate that the need of third molar extraction can be avoided since there were 3 premolar extractions (Type 1) increasing the space available in these quadrants. Only 1 third molar on the non extraction side could have an inconvenient position, preserving the other 3 third molars. In the Type 2 case, the extraction of 1 premolar will favor the third molar position on that side. Although there is a consensus in the literature that despite space available improvement, this is not an assurance that the third molar will erupt.^{11,30} The extraction of healthy teeth with no clinical justification can be avoided with this evaluation, in order to practice a less invasive and more conservative dentistry.

The third molar preservation assists in the functional occlusion, orthodontics anchorage and could help in case of future molar loss, with the possibility of their mesialization, avoiding the use of a prosthesis or an implant.¹⁵

Third molars are the teeth with the highest rate of impaction. The angulation and the available space are strongly associated with it. Their position is very important for orthodontists to assess the treatment mechanics influence and the indication of extraction after treatment or during the follow-up period.^{11,28}

Nowadays, third molar prophylactic extractions have been regularly performed without pathologies to justify it.³¹ According to this, there are many surgical risks in third molars extractions, contrary to the low risk (1 – 2%) of impacted third molars maintaining develop complications, such as periodontal disease, cysts and tumors.³² Besides that, it is very important to consider the mechanic that will be applied, like the use of molars distalization to correct molar relationship. The employment of this mechanic would take the third molars to a more unfavorable position, such as the anchorage system that will be needed. Therefore, it is indispensable to include third molars position in the treatment plan.²⁶

CONCLUSIONS

- In type 1 Class II subdivision malocclusion, there was an improvement in third molar angulations and increases in the space available on the extraction quadrants in maxillary and mandibular arch, after treatment.
- In Type 2 Class II subdivision malocclusion, there was an improvement in the available space and in angulation for maxillary third molars on the Class II side.

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Figure Legends

Fig. 1: Reference lines and cephalometric variables in panoramic radiograph.

Fig.1

Table I. Definitions of cephalometric measurements.

Variables	Definition
Ang3MxCLI	Angle formed by the long axis of maxillary third molar and the infraorbital line on the Class I side
Ang3MxCLII	Angle formed by the long axis of maxillary third molar and the infraorbital line on the Class II side
Ang3MdCLI	Angle formed by the long axis of mandibular third molar and the inter mentonian foramen line on the Class I side
Ang3MdCLII	Angle formed by the long axis of mandibular third molar and the inter mentonian foramen line on the Class II side
Spa3MxCLI	Space available for the maxillary third molar irruption on the Class I side
Spa3MxCLII	Space available for the maxillary third molar irruption on the Class II side
Spa3MdCLI	Retromolar space available for the mandibular third molar irruption on the Class I side
Spa3MdCLII	Retromolar space available for the mandibular third molar irruption on the Class II side
Ang3Mx	Angular difference of maxillary third molars between T2 and T1
Spa3Mx	Linear difference of maxillary third molars between T2 and T1
Ang3Md	Angular difference of mandibular third molars between T2 and T1
Spa3Md	Linear difference of mandibular third molars between T2 and T1

Table II. Intergroup comparison of sex, Class II malocclusion severity distribution, pre- and posttreatment ages, and treatment times.

Variables	Group 1 – Type 1 n = 37		Group 2 – Type 2 n = 25		p
Sex					
Male	17		10		0.642 [†]
Female	20		15		
Malocclusion severity					
¼ Cusp Class II	0%		0%		0.723 [†]
½ Cusp Class II	15%		0%		
¾ Cusp Class II	5%		23%		
Full-Cusp Class II	80%		77%		
	Mean	S.D.	Mean	S.D.	
Pretreatment age	13.18	1.99	13.56	2.46	0.517 ^{††}
Posttreatment age	16.81	2.29	16.76	2.78	0.937 ^{††}
Treatment time	3.40	1.11	3.08	0.90	0.231 ^{††}

[†]Chi-square test^{††}*t* test

Table III – Third molar measurements of Type 1 Class II subdivision malocclusion (paired *t* test).

Variable	Group 1 (Type 1)				p
	T1		T2		
	Mean	SD	Mean	SD	
Ang3MxCLI	55.77	14.80	69.76	12.22	0.000*
Spa3MxCLI	5.76	2.47	8.51	2.45	0.000*
Ang3MxCLII	56.50	13.14	69.54	12.49	0.000*
Spa3MxCLII	6.22	2.56	9.05	2.58	0.000*
Ang3MdCLI	141.23	11.35	135.33	17.98	0.015*
Spa3MdCLI	5.12	3.69	10.52	2.47	0.000*
Ang3MdCLII	142.39	11.42	145.25	16.18	0.249
Spa3MdCLII	4.62	3.67	7.24	3.64	0.000*

*Statistically significant at $P < 0.05$.

Table IV – Third molar measurements of Type 2 Class II subdivision malocclusion (paired *t* test).

Variable	Group 2 (Type 2)				p
	T1		T2		
	Mean	SD	Mean	SD	
Ang3MxCLI	54.35	11.57	58.67	10.43	0.085
Spa3MxCLI	6.25	2.59	6.80	2.30	0.212
Ang3MxCLII	59.84	11.70	70.04	13.35	0.000*
Spa3MxCLII	7.44	2.97	9.85	2.44	0.000*
Ang3MdCLI	137.52	12.95	130.25	17.36	0.020*
Spa3MdCLI	6.40	3.93	8.60	2.92	0.003*
Ang3MdCLII	143.14	11.74	145.75	18.57	0.458
Spa3MdCLII	5.52	3.88	7.18	3.02	0.018*

*Statistically significant at $P < 0.05$.

Table V – Class I and Class II sides T2-T1 change comparisons in Group 1 – Type 1 Class II subdivision malocclusion (paired *t* test).

Group 1 (Type 1)						
Variable	T2-T1		T2-T1		dif	p
	Class I		Class II			
	Mean	SD	Mean	SD		
Ang3Mx	13.99	10.27	13.03	9.71	0.956	0.584
Spa3Mx	2.75	2.84	2.83	2.92	0.07	0.805
Ang3Md	-5.90	14.05	2.86	14.90	8.76	0.008*
Spa3Md	5.40	2.67	2.61	3.03	2.78	0.000*

*Statistically significant at $P < 0.05$.

Table VI – Class I and Class II sides T2-T1 change comparisons in Group 2 – Type 2 Class II subdivision malocclusion (paired *t* test).

Group 2 (Type 2)						
Variable	T2-T1		T2-T1		dif	p
	Class I		Class II			
	Mean	SD	Mean	SD		
Ang3Mx	4.32	12.05	10.19	11.53	5.87	0.036*
Spa3Mx	0.54	2.13	2.41	2.14	1.86	0.000*
Ang3Md	-7.27	14.70	2.61	17.33	9.88	0.033*
Spa3Md	2.19	3.43	1.65	3.27	2.04	0.199

*Statistically significant at $P < 0.05$.

APPENDIX. Random and systematic errors of the measurements performed on panoramic radiographs. (Dahlberg's formula and dependent t tests)

Variable	1st measure		2nd measure		Dahlberg	p
	Class I		Class II			
	Mean	SD	Mean	SD		
Ang3MxCLI	49.8	12.3	58.56	12.3	2.69	0.458
Ang3MxCLII	59.2	12.6	59.9	13.0	1.96	0.326
Ang3MdCLI	37.4	11.5	38.6	12.1	2.66	0.162
Ang3MdCLII	34.3	17.5	34.4	17.9	2.23	0.940
Spa3MxCLI	11.7	3.60	11.6	3.75	0.16	0.385
Spa3MxCLII	11.9	3.42	12.0	3.47	0.19	0.109
Spa3MdCLII	7.21	4.36	7.24	4.42	0.12	0.542
Spa3MdCLII	5.68	3.57	5.66	3.62	0.19	0.824

*Statistically significant difference $P < 0.05$

3 DISCUSSION

3 DISCUSSION

The third molar is a subject frequently researched. Studies currently discuss its prevalence, risk of impaction, surgery techniques and their association with other pathologies.(KIM et al., 2003; BEHBEHANI; ÅRTUN; THALIB, 2006; PATEL et al., 2017)

One of the main discussion associating third molars is if extraction protocols in orthodontic treatments can affect the third molar position. There is no consensus in the literature about this. Some authors concluded that extraction protocols do not improve significantly the third molars position. However, on the other hand, others established that extraction treatment decreases the risk of third molars impaction, with the significant increase in the retromolar space.(SAYSEL et al., 2005)

Concerning the Class II subdivision malocclusion treatment with asymmetric extractions, one study compared the third molar space and angulation asymmetry in Class II subdivision malocclusion with normal occlusion before treatment in the corrected oblique radiograph. It was found in Type 1 only a significantly greater space asymmetry for mandibular third molars and in Type 2 a significantly greater asymmetry for maxillary third molars. This result was justified due to the Class II subdivision malocclusion etiology, which is primarily by the distal positioning of mandibular first molars and secondarily by a mesial positioning of maxillary first molars on the Class II side. Regarding the angulation, no statistically significant difference was found in both groups.(JANSON et al., 2007b) Therefore, this study evaluated the angular and space differences between the Class I and Class II sides in each type of the Class II subdivision malocclusion.

The results of this study agree with previous researches that concluded that premolar extractions increase significantly the retromolar space and with this gain of space, also improve significantly third molar angulations on the extraction quadrants. On the other hand, some authors concluded that the increase of retromolar space is not an assurance that third molar will erupt.(STAGGERS; GERMANE; FORTSON, 1992; KIM et al., 2003)

Another question that is currently debated is the third molar initial position. It was also found that the third molar which presented with an unfavorable position after

treatment, had smaller improvement or even had worsening their angulation. This result also agrees with other studies that showed little changes on third molar that presented mesio angulated at pretreatment. In some cases, it was observed impacted third molars after premolar extraction treatment, because it presents inconvenient angulation (mesio angulation) before treatment.(TÜRKÖZ; ULUSOY, 2013)

According to this, this assessment it is important to show the necessity of evaluating the third molars position, including it in the orthodontic treatment plan. Observing if the mechanic treatment will interfere in their position. Like a mechanic distalization, that requires third molar extractions.(SAYSEL et al., 2005)

However, in a treatment that will be necessary premolar extractions, it is important to preserve the third molars, in a tend to practice a less invasive and more conservative dentistry. Seeing that third molar extraction has surgery risks higher than obtaining other pathologies, like periodontal inflammatory reactions, cysts, and tumors.(MARCIANI, 2007)

4 CONCLUSION

4 CONCLUSION

- For Type 1 Class II subdivision malocclusion, there was an improvement in third molars angulation on the extraction quadrants and increases in the space available in maxillary and mandibular arch, after treatment. When comparing the sides, only the mandibular arch presented differences, showing improvements on the Class I side.
 - In Type 2 Class II subdivision malocclusion, there was an improvement in the available space and in angulation for maxillary third molars on the Class II side after treatment, also observed when comparing the sides. In the mandibular arch after treatment, third molars presented a distal angulation on the Class I side and mesial angulation on the Class II side, also observed when comparing between the sides. The available space increase on both sides after treatment.
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REFERENCES

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APPENDIX

**APPENDIX A - DECLARATION OF EXCLUSIVE USE OF THE ARTICLE IN
DISSERTATION/THESIS**

We hereby declare that we are aware of the article "THIRD MOLARS POSITION AFTER CLASS II SUBDIVISION MALOCCLUSION TREATMENT AFTER ASYMMETRIC EXTRACTIONS" will be included in Dissertation of the student Jéssica Ferreira de Almeida and may not be used in other works of Graduate Programs at the Bauru School of Dentistry, University of São Paulo.

Bauru, November 30th, 2018.

Jéssica Ferreira de Almeida
Author

Signature

Guilherme Janson
Author

Signature

Author

Signature

Author

Signature

ANNEXES

ANNEX A. Ethics Committee approval, protocol number 71683417.9.0000.5417 (front).

USP - FACULDADE DE
ODONTOLOGIA DE BAURU DA
USP

PARECER CONSUBSTANCIADO DO CEP**DADOS DO PROJETO DE PESQUISA**

Título da Pesquisa: Posição dos terceiros molares no pós-tratamento da má oclusão de Classe II, subdivisão

Pesquisador: JESSICA FERREIRA DE ALMEIDA

Área Temática:

Versão: 2

CAAE: 71683417.9.0000.5417

Instituição Proponente: Universidade de São Paulo

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 2.351.604

Apresentação do Projeto:

A incidência de impacção dos terceiros molares é maior que qualquer outro dente. Apesar de vários fatores interferirem na irrupção dos terceiros molares, é a presença do espaço que é decisiva para a irrupção dos mesmos. A impacção muitas vezes ocorre pelo fato da presença de espaço ser influenciada pela remodelação óssea e pelo tratamento ortodôntico.

Objetivo da Pesquisa:

Avaliar as alterações no pós-tratamento da angulação e a proporção de irrupção dos terceiros molares superiores e inferiores nos casos de Classe II após extrações assimétricas de pré-molares.

Avaliação dos Riscos e Benefícios:

Não há riscos aos voluntários uma vez que serão analisadas documentações na guarda da disciplina de Ortodontia da FOB/USP. As identidades das documentações serão preservadas.

Após a coleta e análise dos dados será possível compreender melhor as possíveis causas da impacção dentária.

Comentários e Considerações sobre a Pesquisa:

Pesquisas com potenciais elucidativos sem riscos aos voluntários são muito importantes. O cálculo amostral foi calculado corretamente, o que conferirá fidedignidade aos resultados. Espera-se uma melhor compreensão sobre a impacção dentária em pacientes com Classe II após as análises dos

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ANNEX A. Ethics Committee approval, protocol number 71683417.9.0000.5417 (verso).

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USP**

Continuação do Parecer: 2.351.604

resultados.

Considerações sobre os Termos de apresentação obrigatória:

O trabalho pede dispensa do TCLE por fazer uso de documentação arquivadas nas dependências da disciplina de Ortodontia da FOB/USP. É relatada a dificuldade de contato com os voluntários por conta do acervo antigo. Além disso, há declarações dos pacientes ou responsáveis autorizando o uso destas documentações em outros estudos.

Todos os outros termos foram apresentados corretamente.

Foi feita a correção do número de participante na Plataforma Brasil e no Projeto de Pesquisa.

Recomendações:

Recomendo a aprovação do presente projeto.

Conclusões ou Pendências e Lista de Inadequações:

Julgo aprovado o presente projeto.

Considerações Finais a critério do CEP:

Esse projeto foi considerado APROVADO na reunião ordinária do CEP de 11/10/2017, com base nas normas éticas da Resolução CNS 466/12. Ao término da pesquisa o CEP-FOB/USP exige a apresentação de relatório final. Os relatórios parciais deverão estar de acordo com o cronograma e/ou parecer emitido pelo CEP. Alterações na metodologia, título, inclusão ou exclusão de autores, cronograma e quaisquer outras mudanças que sejam significativas deverão ser previamente comunicadas a este CEP sob risco de não aprovação do relatório final. Quando da apresentação deste, deverão ser incluídos todos os TCLEs e/ou termos de doação assinados e rubricados, se pertinentes.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_954697.pdf	21/09/2017 14:51:28		Aceito
Folha de Rosto	folharosto.docx	21/09/2017 14:09:55	JESSICA FERREIRA DE ALMEIDA	Aceito
Projeto Detalhado / Brochura Investigador	Projeto.docx	27/08/2017 13:59:35	JESSICA FERREIRA DE ALMEIDA	Aceito
Declaração de Instituição e Infraestrutura	Declaracao_infraestrutura.pdf	17/07/2017 14:07:44	JESSICA FERREIRA DE ALMEIDA	Aceito

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ANNEX A. Ethics Committee approval, protocol number 71683417.9.0000.5417 (front)

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Continuação do Parecer: 2.351.604

Outros	Questionario_tecnico_pesquisador.doc	17/07/2017 14:01:51	JESSICA FERREIRA DE ALMEIDA	Aceito
Declaração de Pesquisadores	Declaracao_compromisso_pesquisador.pdf	17/07/2017 13:55:18	JESSICA FERREIRA DE ALMEIDA	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.pdf	17/07/2017 13:52:02	JESSICA FERREIRA DE ALMEIDA	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

BAURU, 26 de Outubro de 2017

Assinado por:

Ana Lúcia Pompéia Fraga de Almeida
(Coordenador)

Endereço: DOUTOR OCTAVIO PINHEIRO BRISOLLA 75 QUADRA 9

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ANNEX B. Patient's informed consent exoneration (front)

**Universidade de São Paulo
Faculdade de Odontologia de Bauru****Departamento Odontopediatria, Ortodontia e Saúde Coletiva
Disciplina de Ortodontia****DISPENSA DE TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO E TERMO DE ASSENTIMENTO**

Solicitamos ao Comitê de Ética em Pesquisa, FOB-USP, a dispensa do Termo de Consentimento Livre e Esclarecido e Termo de Assentimento, do projeto de pesquisa **"Posição dos terceiros molares no tratamento da má oclusão de Classe II, subdivisão"**, de autoria de *Jéssica Ferreira de Almeida* sob a orientação do Prof. Dr. *Guilherme Janson*.

Tal solicitação justifica-se pelo fato da amostra ser retrospectiva. Os prontuários estão sob os cuidados da disciplina de Ortodontia do Departamento de Odontopediatria, Ortodontia e Saúde Coletiva. Estes prontuários são do acervo desde 1973, constituindo uma dificuldade de contato com os pacientes devido ao tempo decorrido desde o tratamento feito até a data presente. Vale ressaltar que os pacientes, quando atendidos da clínica de Ortodontia, assinam a **"AUTORIZAÇÃO PARA DIAGNÓSTICO E/OU EXECUÇÃO DE TRATAMENTO ORTODÔNTICO"** (modelo anexo) a qual aprova tanto a execução do tratamento quanto seu uso para "quaisquer fins de ensino e de divulgação em jornais e/ou revistas científicas do país e do exterior", desta forma aprova-se também o uso dos dados do seu prontuário para o ensino em pesquisas científicas.

A dispensa do termo de Assentimento se deve ao fato de os pacientes da amostra, no momento da execução do exame, serem tanto menor de 18 anos quanto adultos, não sendo diferenciado para a pesquisa, como critério de inclusão ou exclusão. Tais pacientes também foram autorizados pelo responsável no documento **"AUTORIZAÇÃO PARA DIAGNÓSTICO E/OU EXECUÇÃO DE TRATAMENTO ORTODÔNTICO"**. Os nomes e dados pessoais dos pacientes não serão divulgados em nenhum momento, mantendo desta forma o sigilo profissional (Artigo 9º do Código de Ética Odontológico) e a privacidade dos participantes da pesquisa durante todas as fases e assumimos o compromisso de cumprir as exigências contidas na Resolução CNS Nº 466, de 12.12.12.

Bauru, 12 de julho de 2017.

Jéssica Ferreira de Almeida
Orientada

Prof. Dr. Guilherme Janson
Orientador

ANNEX B. Patient's informed consent exoneration (verso)

**UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU
CLÍNICA DE ORTODONTIA**

**AUTORIZAÇÃO PARA DIAGNÓSTICO E/OU EXECUÇÃO DE
TRATAMENTO ORTODÔNTICO**

Por este instrumento de autorização por mim assinado, dou pleno consentimento à FACULDADE DE ODONTOLOGIA DE BAURU-USP para, por intermédio de seus professores, assistentes e alunos devidamente autorizados, fazer diagnóstico, planejamento e tratamento em minha pessoa ou meu filho menor de idade _____, de acordo com os conhecimentos enquadrados no campo dessa especialidade.

Concordo também, que todas radiografias, fotografias, modelos, desenhos, históricos de antecedentes familiares, resultados de exames clínico e de laboratório e quaisquer outras informações concernentes ao planejamento de diagnóstico e/ou tratamento, constituem propriedade exclusiva desta FACULDADE, à qual dou plenos direitos de retenção, uso para quaisquer fins de ensino e de divulgação em jornais e/ou revistas científicas do país e do exterior.

Bauru, ____ de _____ de 19 ____.

Assinatura do paciente ou responsável

R.G. Nº: _____

Nome: _____

Endereço: _____

CEP: _____ Telefone: _____